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NETHERLANDS EAST-INDIAN SAN-FRANCISCO-COMMITTEE.

DEPARTMENT OF AGRICULTURE INDUSTRY & COMMERCE

No. XXIV

CINCHONA.

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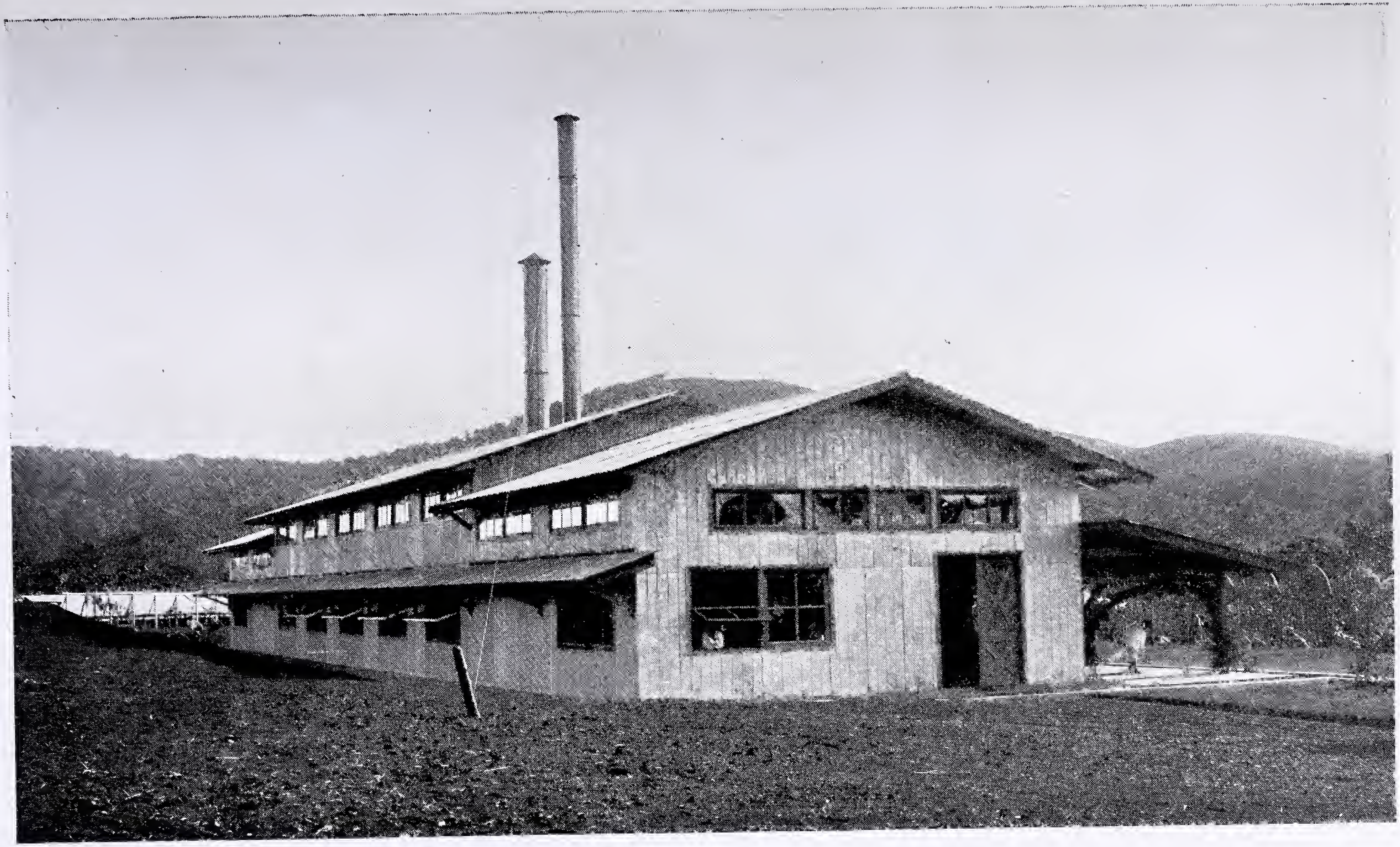


Building for artificial drying of Cinchona bark.

CINCHONA.

ıtroduction. The Cinchona bark, used for medical purposes, is obtained from different species of Cinchona, a botanical family belonging to the genus of the Rubiaceae. It owes its efficiency as a febrifuge to the alcaloïds which are its principal constituants and of which quinine is universally reputed. While quinine is used in the treatment of malaria, the bark finds employment in the manufacture of tonics.

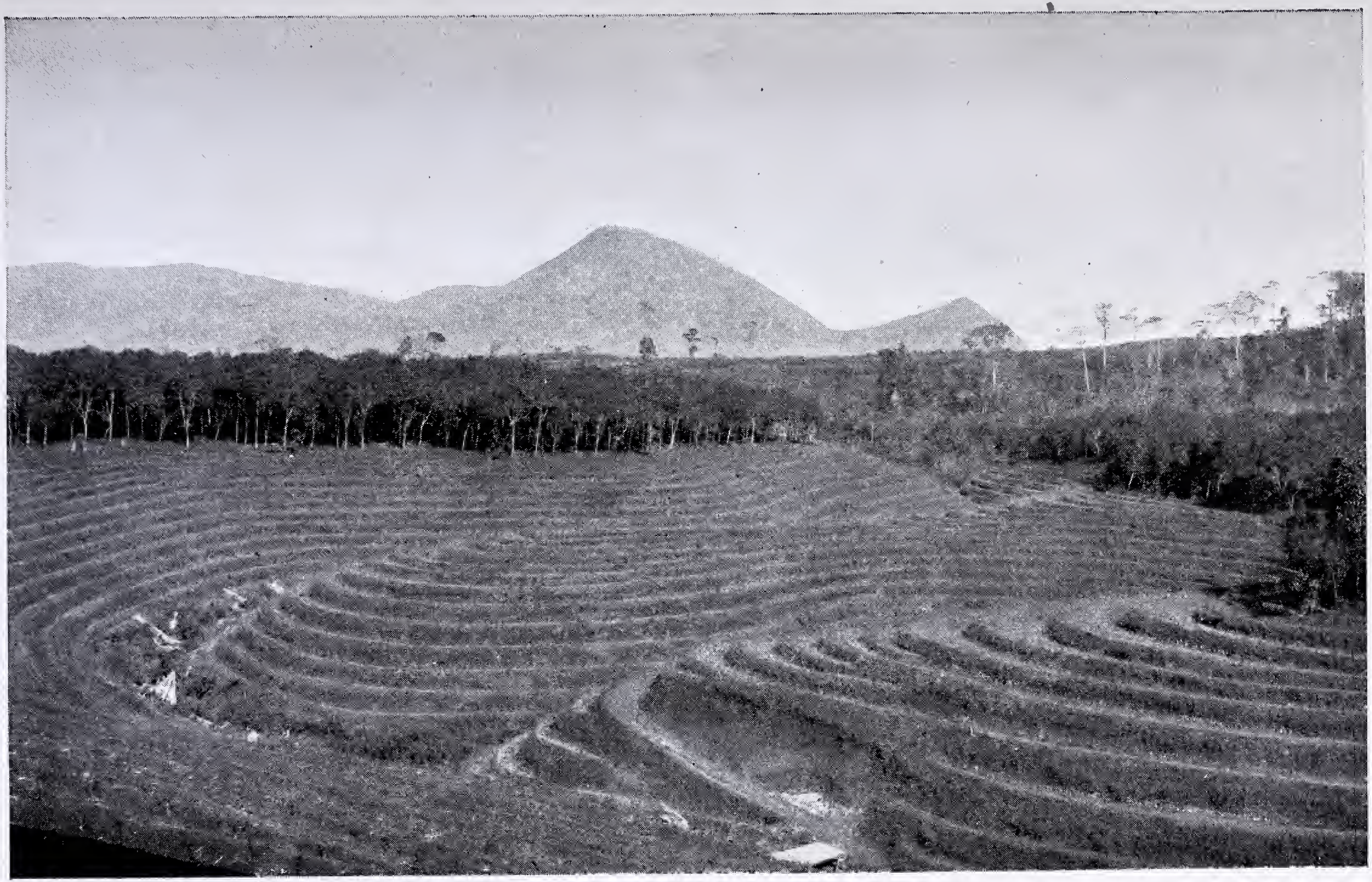
Cinchona originates in wild state from South-America, where it is found in the forests of the Andes, in the zône between 10° N. L. and 19° S. L. at an elevation above sealevel varying from 3000 to 9000 feet. At the present time Java almost exclusively supplies the market with Cinchona bark, Cinchona being cultivated only on a very small scale in British India, Ceylon, the West-Indies and tropical Africa.

Cinchona introduced in Netherlands-East-India.

In Netherlands-East-India the cultivation of Cinchona dates from the beginning of the second half of the 19th century. The history of the cultivation in Java is worthwhile recording here in a few lines. Transferring Cinchona to other countries was about the middle of the 19th century a new departure, which Europe eagerly went in for. About that time the medical world of Europe had learned more and more to appreciate the therapeutical qualities of quinine and became more and more worried about the unsufficient and uncertain supplies of Cinchona bark in the market. This was of course due to the unsatisfactory conditions of production in Peru and Bolivia, and it was therefore considered most important to secure quarters more suitable for the growth of the tree in a place where it could produce bark abundantly for the benefit of the whole world.

The result was, that colonizing countries such as England, France and Holland quickly responded to the general opinion, which was highly in favor of experiments to be made without delay. Experiments made by France in Algeria soon failed, whereas England only succeeded in introducing a poor low graded breed of low value into India. Experiments made by Holland date as far back as 1839, when only one cutting had been secured and brought to growth in Java. It may be possible that no one thought of securing seeds from Peru or Bolivia or that this plan was considered impracticable. Anyhow no efforts were made to secure such seeds for Java, but evidently England's and France's misfortune spurred the Dutch to do everything possible in order to solve this problem.

The Government of the Netherlands decided to take the matter in hand. A scientific botanist, Dr. Hasskarl, was charged with a mission to Peru and Bolivia, where he continuously met with difficulties and was kept busy for a couple of years with secretly and dangerously hunting for and scrutinizing the different species, and recording their botanical and chemical properties. Ultimately however some parcels of seeds were secured, and it was in 1854 that by the aid of a Dutch man of war, which was kept in readiness at La Paz, these seeds could be sent to Java and there formed the first generation of some 75 Cinchona trees of the Calisaia and Succirubra varieties. In the following years more seed was collected, thanks to the good offices of the Netherlands consuls in Bolivia, Peru and Ecuador, thus extending the Java breeds of Cinchona. The most important parcel of seeds, which afterwards arrived in Java, was a pocketful offered for sale by an Englishman, G. Ledger, in 1865. The offspring thereof proved, when the bark was analysed in 1872, to surpass all other kinds then known as regards



Terraced ground ready for planting.

contents of quinine and purity, it containing besides quinine only a very small percentage of alcaloïds. After the discoverer, this superior species are called *Ledgeriana*.

ecies and
rieties.

More than 20 species of Cinchona are described, each of which showing a marked predilection for a determinate locality. They certainly very little diverge from each other, and easily form hybrids, so that the already small distinctives of the species still grow smaller. Consequently the botanical derivation was in most cases uncertain and therefore chemical analysis as a determinative of species has successfully taken the place of botanical diagnosis. Neither does every species of Cinchona show the same contents of alcaloïds, nor do these in the same proportion and many of them are of no value as medicine. Some plants, which do not belong to the family of Cinchona, but which are reckoned to the same genus, viz, the *Cinchoneae*, show the same alcaloïds as present in Cinchona; there are the *Ladenbergia* and the *Remyca*, which yield the so-called *China Cuprea*. The *Cinchona Calisaya* cultivated in Java, shows a great variebility, the most famous variety being the *Cinchona Ledgeriana*. This variety, as well as a hybrid of *C. Ledgeriana* and *C. Succirubra*, are the chief producers of the so-called factory-barks (for the manufacture of quinine sulphate), whereas the so-called pharmaceutical barks are obtained from *C. Succirubra*, and from a hybrid of *C. Officinalis* and *C. Succirubra*, viz., *C. Robusta*.

ultivation in
etherlands-
ast-India.

Experiences brought to light that an elevation above sealevel of about 5000 feet, and a temperature of 16° to 17° C. is best for the cultivation of Cinchona. The best soil is one of mixed composure, being rich to a great depth and of a loose texture. Doubtless the slopes of the mountains, the tops of which are still covered with virgin forests, are the most appropriate for the cultivation. Even very steep slopes can be utilised for plantations, provided they are terraced amphitheatrically in order to facilitate the planting as well as the cultivation, and to prevent the wash of soil by heavy rains. Land of good quality can be utilised uninterruptedly for 3 or 4 generations of Cinchona trees, although in such cases some decrease in the amount of alcaloid has been noted in comparison with the plantations on virgin forest soil.

Rearing.

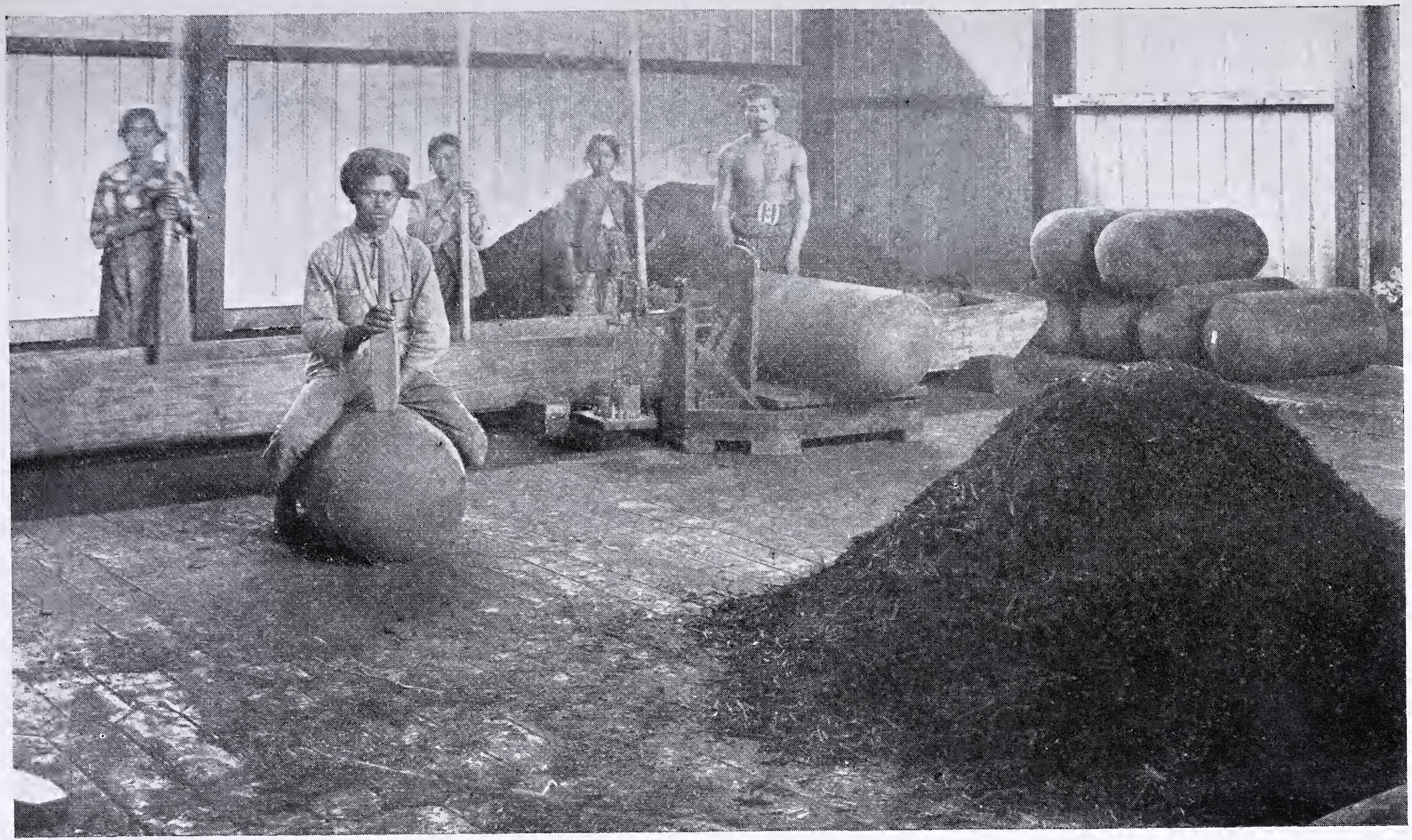
The young plants are raised from the seeds in nursery-beds, the seeds being obtained from specially selected superior trees, which are exclusively kept for this purpose. After 6 months the seedlings are strong enough to be transplanted to other nurseries. A couple of months thereafter, beginning with the biggest ones, they for the third time are transplanted to fresh nurserybeds, where they are placed in rows at distances of half a foot. There they remain until they have reached a height of 2 to 3 feet, and then they are planted out in the gardens.

Artificial multiplication.

Next to the rearing of the plants from seeds, which may be called natural multiplication, stands the artificial one by grafting. The last method is preferable, because it better preserves the type. But even then the identical chemical constitution is not always secured, owing—as experience has proved—to the influence of the constituants of the soil.

Harvest.

After being introduced in Asia, Cinchona created a problem as to the best method of harvesting. Different trials were made, among others with the mossing system, that means by partially stripping off the bark, and covering the denuded parts with moss. Another way was to cut down the stumps at a certain height from the ground in order to let them renew their stems by fresh buddings. At the present time the following method is mostly applied. According to planting distances parts of the plantations containing trees of 3 or 4 years are simply cut down and immediately replanted. The



Packing of Cinchona bark destined for Quinine factories.

bark of the felled trees is then collected. On older plantations the thinning out method is mostly applied. The harvesting of the barks differs according to their being destined for pharmaceutical purposes or for the manufacturing of quinine. Winning so-called pharmaceutical bark is done by removing a ring of the bark at the stem's base. When felled, the stems are gauged in squares of 1/4 to 1 Metre length and 1/4 of a Metre width, which squares of bark are then removed. Sometimes the mosses on the bark are left unhurt, these giving a higher commercial value to the barks. If no mosses are to be considered the periderma is brushed and beaten with a wooden hammer, by which process the bark frees itself from the stem. The fresh bark is in a shadowy place dried by means of bamboo poles, on which the pieces of bark are saddled in order to preserve their cylindrically curved shape. When curved in such a shape the drying of the cylinders is finished in the sunshine. Trade is very anxious to get barks of a silvery white colour. So they are carefully dried in the open air as far as is possible, and then sorted. They are marketed under the name of „pipe barks''. Barks of roots and branches, which cannot be cut in the above mentioned measurements, form a distinct assortment, known as „broken pipes''.

In harvesting bark for manufacturing purposes the stem is beaten with a wooden hammer by which the bark loosens itself and this afterwards is scraped with a horny knife.

Rootbark.

Sometimes the periderma of the rootbark of the pharmaceutical product is removed by washing and brushing the pieces. If water is available it is always advisable to clean the rootbark by washing the sand out.

Drying.

The fresh bark, when being just stripped off, contains a large quantity of water, which amounts to some 75 percent. By drying in the air 60 to 65 percent of this evaporates and the remaining 10 to 15 percent can only be removed by artificial drying at a temperature of 100° C. The temperature should not be higher, as otherwise the percentage of quinine decreases. Newly harvested barks, being artificially dried without first drying in the sun, give an inferior product of strong colour.

Sundrying is done on removable wooden floors which as they stand on rails can at night or in case of rain be rolled underneath a shed.

Packing.

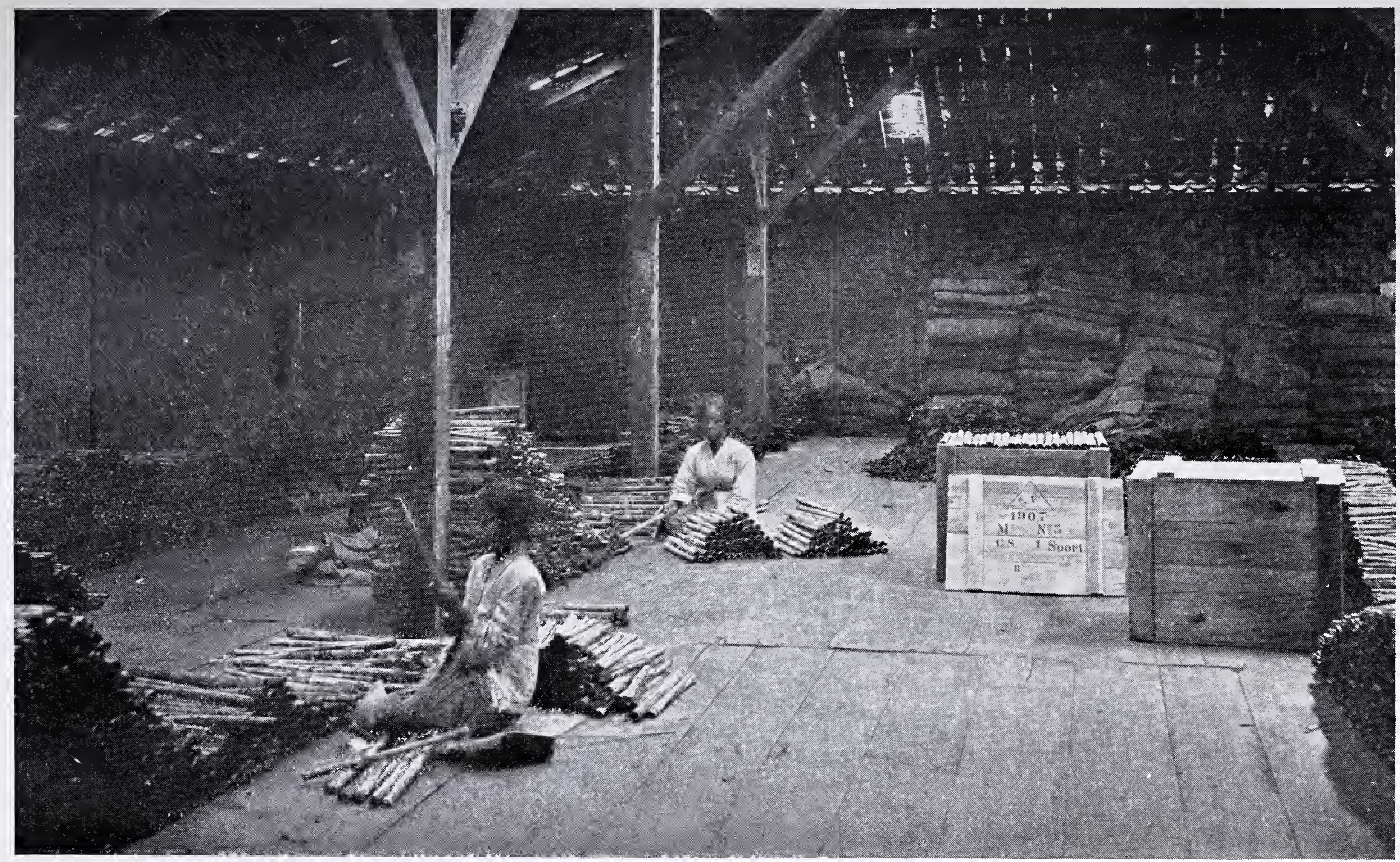
When dried the bark is packed. The dust in bags and the pipes in cases. As the trade distinguishes stembarkpipes 1st and 2nd quality, damaged pipes, broken pipes and chips, a careful sorting of the pipe produce is to be done before packing.

Chemical composition of the bark.

The best known principal alcaloïds, present in the bark are: quinine, quinidine, cinchonine and cinchonidine. Whilst formerly the bark fibres were thought to contain more alcaloïds than the parenchym, closer investigation has shown that the parenchym, specially the outside cortex is the bearer of the alcaloïds. As far as the location concerns, it has been found that the alcaloïds are found in every part of the tree, but principally in the bark of the stem, the outside cortex being always richer in alcaloïds than those inside. The age of the tree influences the quantity of alcaloïds in such a way, that the maximum percentage is reached in the sixth year, after which period it slightly decreases until the twelfth year, at which age no more change has been observed in the alcaloïds available in the tree.

The *Ledgeriana*-variety, which in bark of the stem as well as in that of the root is richest in quinine has in the bark of the former more Cinchonine than in that of the latter.

Moreover the analysis of rootbark of *Ledgeriana*-trees 12, 7, 4, 5 and 2½ years old have proved



Sorting and packing of Pharmaceutical bark.

the superiority of the younger roots over the older ones.

Among the influences which effect the production are to be recorded: disease, character of the soil, manuring, shade, renewal of the bark, death by frost, drying at too high a temperature, and exposing bark dust to dampness.

a-produce
export.

The total number of private Cinchona-plantations in Netherlands East India in 1912 amounted to 118, of which 4 are located in Sumatra and the others in Java, mostly (84) in the West of the island.

Statistics of the last years show clearly that Java virtually holds the monopoly of the world's production of Cinchona. This amounted (in tons) to:

	1908.	1909.	1910.
Production of Java	8,540	8,697	8,780
,, ,, British India appr.	446	446	446
,, ,, all other countries appr.	200	200	200
Total appr.	9,186	9,343	9,426

Exports of
rks from
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st-India.

The export of bark from Netherlands East India amounted, according to private statistics, (in tons) to:

	1910.	1911.	1912.
By Government	588	541	845
,, private companies	8,697	8,118	7,869
Total	9,285	8,659	8,714

of which were shipped (in tons):

	1910.	1911.	1912.
From Java to Amsterdam	8,974	8,425	8,587
,, ,, to London	223	209	87
,, Sumatra to Amsterdam	88	25	40
Total	9,285	8,659	8,714

arket.

As long as the production of Cinchona bark was limited to its native country, London, Paris, Hamburg and New-York were the principal markets for the product. Owing to the collection of the bark as a forest produce, supplies however were irrigular. Supplies of bark at that time were small, and prices extraordinarily high. Naturally the transfer of the cultivation of Cinchona to East Asia has totally changed the aspect of this trade. Not only did South-America lose its monopoly, but the market was also gradually transferred. Whereas the Indian and Ceylon product were marketed in London, the Java product found its way to Amsterdam.

Sale of the Java Cinchona bark.

Until the month of July 1913 Cinchona bark was sold by public auction in Amsterdam, but the stability of supply and demand being disturbed, and prices falling lower and lower, producers of Java Cinchona bark in that month conferred with the buyers of Cinchona bark, who were limited to the owners of about eight quinine factories, about a reorganisation of the market. Now the combined quinine factories have bound themselves to take up the Java production up to a guaranteed quantity of bark containing 525 tons of quinine sulphate at a minimum price of 5 cents Neth. currency per unit. The quinine manufacturers apply at Amsterdam 10 times a year for the quantity of bark which each of them desires to receive, and a central office controls the receipts, analysis and deliveries of bark, and fixes the quotations.

Average percentage of barks for manufacturing purposes.

The bark offered at the Amsterdam auctions in 1910, 1911 and 1912 showed an average percentage of quinine sulphate of 6.38%, 6.59% and 6.33% respectively.

Unit price.

The average-unit price amounted to 3.15 cts. in 1910, 3.11 cts. in 1911, and 3.81 cts. Neth. currency in 1912.

Factory at Bandoeng.

Java possesses a quinine factory situated at Bandoeng in the Preanger district, called the „Bandoengsche Kininefabriek". The quantities of quinine exported by this factory amounted to: 3,851 cases in 1910, 5,597 cases in 1911, and 3,225 cases in 1912.

The destinations of these quantities are shown by the following table:

	1910. Cases.	1911. Cases.	1912. Cases.
Holland	23	133	600
Genoa	380	76	478
United Kingdom	2,516	3,695	1,108
Singapore	72	456	358
Port-Saïd	—	14	21
Japan	353	338	50
U. S. A.	462	852	575
Various	45	33	35